

## IMPORTANCE OF PROMOTING METACOGNITIVE AWARENESS AT UNIVERSITY

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### **Abstract**

*The aim of this study is to furnish a reliable theoretical overview on metacognitive awareness. This research is carried out to (1) familiarize the researchers with the definition, components and sub-components of metacognitive awareness (2) discuss a brief outline of metacognitive awareness along with its origin and essence from the point of view of its historical development (3) link metacognitive awareness to a number of other constructs, including motivation (4) illustrate the features of self-regulated students and their recruited metacognitive strategies and (5) briefly examine the major challenges in the implementation of metacognitive awareness.*

*In conclusion, this research reveals that the analysis of metacognitive awareness and its components gives rise to a new notion of auto-noetic (self) knowledge of learners through planning, monitoring and reflectively evaluating task performance, and creates higher levels of self-efficacy which provides students with different educational contexts in which they are able to have more self-confidence, get more positive feedback both from an instructor and classmates and cultivate in learners more self-regulatory characteristics that enable them to learn autonomously, be completely equipped with motivation and be welcoming to challenges.*

*The study provides benefits to both learners and educators. Learners can receive guidance on how to foster metacognitive awareness for being more competent learners. Furthermore, it provides meaningful insights for curriculum developers to provide metacognitive awareness-based curricula.*

**Keywords:** Academic achievement; Metacognitive awareness; Metacognitive strategy; Self-efficacy; Self-regulated learning.

## Background

There is no doubt that the quality of education has increased with the development of sciences. In fact, the traditional way of education which was teacher-centered education, has been changed gradually to a learning-centered education which encompasses active and innovative involvement of learners in teaching and their thinking about all aspects of learning. In addition, metacognitive awareness, metacognitive strategies, motivation, controlling and monitoring learning process are also fundamental parts of learning-centered education in university studies.

Discovering the successful students' characteristics will help the instructors find out the most appropriate activities for other students in the class in order to have more successful learners. Therefore, exploring the student internal and external (such as teaching) has got a great influence on learning process and performance of students (Harvey and Goudvis, 2007). In recent years, students' features like self-efficacy, metacognitive strategies, metacognitive awareness, self-regulation have been considered as topics of studies in many areas of research (Black and Wiliam, 2009; Caliskan, 2010; MCcaig et al, 2011; Zimmerman and Moylan, 2009). Furthermore, students' differences have got a great impact on students' autonomy and self-regulation and focal attention in autonomous learning. Moreover, understanding individual differences that are closely linked to learner autonomy and self-regulation (e.g., learner strategies), and also how these individual differences operate within a learner's self-regulatory system has become as important as ever. Students' metacognitive awareness as a bigger field compared to metacognitive strategies which includes within it is the most important factor for the development of autonomy and self-regulation of the students.

Metacognition is associated with numerous fields of study, psychology, philosophy of mind,...etc. Consequently, it is considered as a multidimensional and mysterious study subject including metacognitive awareness, metacognitive skills, metacognitive beliefs, meta-memory, self-regulation, self-management, executive control,etc. Therefore, metacognitive teaching is a professional duty and requires knowledge in different fields of studies and does not consist of only some simple and easy tasks to the instruction. It is vital to include metacognitive strategies to the class activities to foster metacognitive awareness and self-regulating learners.

Flavell (1976,1979) was the first psychologists who tried to make memory and recall better by considering merits of metacognitive awareness and recruiting related strategies which finally led to more research on self-knowledge (Fleming and Dolan, 2012). There have been numerous theoretical and empirical studies on metacognitive awareness during recent decades. Yet, the psychological and neural affairs which are associated with metacognitive awareness have not been well-determined.

Based on Hasselhorn and Labuhn (2011), controlling over learning process which is mostly possible via the development of metacognitive strategies is important since it permits individuals to exercise control over their own learning. The difference among various learners regarding their learning outcomes is likely to illustrate through the amount of their self-control and self-regulation. Whenever a student is metacognitively aware of his learning, he takes charge of his own learning, and consciously directs his learning (Hacker et al., 2009).

There are great differences between metacognition, which is performance regulation with monitoring and evaluating on the learning outcome named as “thinking about thinking”, and cognition, which is associated with performance. (Fleming et al., 2014).

One of the main factors for fostering metacognitive awareness is motivation which is highly interrelated concept with self-efficacy. Students’ motivation is related to their desires and reasons for actively taking part in their learning processes. Therefore, it is important to assist students to recognize where their motivation for educational success exists. There are many motivational factors such as parents, instructors and setting and manner in which it has been obtained or transferred. A learner should reach this belief that the academic target is accessible to be able to have self-motivation. In addition, curiosity as the main motivator for the learner to discover and apply new and useful metacognitive strategies to foster metacognitive awareness is the main part of the battle to become a self-regulated learner.

All the stipulated points highlight the need for further clarification of metacognitive awareness complex concept and how it can be fostered. Thus, the importance of fostering metacognitive awareness for academic achievement on one hand and the above problems such as multifaceted nature of metacognition and lack of clarity of links among psychological and neural affairs of

metacognitive awareness, self-efficacy and self-regulated learning, on the other hand, have encouraged the researchers to conduct this work.

In order to reach the aim of this article which is overviewing the concept of metacognitive awareness and its components which leads to self-efficacy and self-regulated learning the following sections of the paper attempt to provide a useful theoretical guide that helps understanding not only what the distinct components of it are but also how they link together. We begin our analysis with the origin, definitions, meanings and components of metacognitive awareness, then move to a brief explanation about neural structures recruited during metacognitive awareness and relations among metacognitive awareness, self-efficacy and self-regulation. This paper there after finalizes with a conclusion and the educational implications.

### **Metacognition origin, definition and its related components**

Metacognition was stipulated by John Flavell in 1975 for the first time. He defined this term which has the rudimentary role in the supervision and management of cognitive learning as following:

*One's knowledge concerning one's own cognitive processes and products or anything related to them (...) [and] refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes (...), usually in the service of some concrete goal or objective.* (Flavell, 1976, p. 232).

After Flavell, Ann Brown (1987) was the most prominent scientist in this field and introduced various types of monitoring and regulation including checking, planning, selecting, inferring and making judgments about what a learner knows or does not know about how to perform an activity (Brown, 1987). She emphasized that:

*Metacognition refers to understanding of knowledge, an understanding that can be reflected in either effective use or overt description of the knowledge in question* (Brown, 1987, p. 65).

As she mentioned above, metacognition has got two parts, awareness of knowledge and understanding of knowledge. However, we can say understanding has got numerous levels. Moreover, it is possible that a learner applies knowledge effectively while he cannot describe how he used it.

Determining a single and comprehensive meaning for metacognitive term is not an easy task since metacognition is not only connected to various study fields, psychology, philosophy of mind,...etc but also multifaceted topics including metacognitive awareness, metacognitive skills, metacognitive beliefs, meta-memory, self-regulation, self-management, executive control, ...etc. That is why Flavell (1979) called it “fuzzy” term and Brown (1987, p. 65) described it as “mysterious”.

Referring to Brown (1987) and Flavell (1979), the ‘meta’ means higher-order cognition. It encompasses two sections: metacognitive knowledge and metacognitive regulation. 1) Metacognitive knowledge (the learner’s knowledge about his cognitive abilities), the learner’s knowledge of particular activities and the learner’s knowledge of different strategies including when to use these strategies. 2) Metacognitive regulation describes how a learner manages and regulates his cognitive process.

As Hacker et al. (2009) explains ‘going meta’ is another term used to refer to metacognition which means you as the learner are considered as another person who observes the learning process. Metacognition includes awareness of the learning process, learning evaluation, creating metacognitive strategies and implementing these strategies (Hacker et al., 2009). According to Flavell metacognition has got two different but interrelated parts, metacognitive knowledge which is awareness of one’s thinking and metacognitive regulation which is the ability to manage one’s own thinking process. Flavell (1979) categorizes three sorts of metacognitive knowledge: 1) Awareness of knowledge which is when it involves understanding what one knows, what one does not know, and what one wants to know. This category may also include an awareness of other’s knowledge. 2) Awareness of thinking which is understanding cognitive activities 3) Awareness of metacognitive strategies and how to use and describe them.

According to Schraw and Dennison (1994), metacognition is defined as thinking well, understanding and controlling one’s learning. It includes two sections “knowledge of cognition” and “regulation of cognition”. Knowledge about cognition includes three sub-categories of declarative knowledge (knowledge about self and about strategies), procedural knowledge (knowledge about how to use strategies), and conditional knowledge (knowledge about when and why to use strategies). Regulation of cognition encompasses five sub-categories of planning,

information management strategies, comprehension monitoring, debugging strategies, and evaluation.

The theory of metacognitive regulation which is widely cited in the research literature is Nelson and Narens' (1990) Model of Metacognition includes two levels of the object level and the meta level. The object level is where cognitive processes or 'one's thinking' happens. At the object level, cognitive strategies (e.g., decoding) are used to help the learner to achieve the particular goal (understanding the meaning of the text). The meta (higher-order) level is where your 'thinking about thinking' takes place and metacognitive strategies are recruited as the learner is thinking about how well he understood the text (monitoring). If he did not get well, he may reread or use a dictionary (controlling).

Two main words related to metacognition are self-regulation (self-regulated learning) which is explaining self-regulation in academic context, and executive functioning, which is necessary cognitive processes for reaching the objectives. The behavioral output for these executive functions is called metacognition (Jansiewicz, 2008). Self-regulation and metacognition are sometimes used interchangeably. However, Whitebread and Pino Pasternak (2010) state that "metacognition refers specifically to the monitoring and control of cognition, while self-regulation refers to the monitoring and control of all aspects of human functioning, including emotional, social, and motivational aspects" (p. 693).

Caliskan (2010) states that a learner who applies the appropriate metacognitive strategies, can foster metacognitive awareness by thinking regarding the subject of what he is going to learn and planning time that he is going to allot for learning. Furthermore, it seems that metacognitive awareness is the most crucial parameter in motivation creation. Any positive and negative changing in metacognitive awareness has the same changing direction in student's motivation too. There are different names for the word "motivation" which is determined by its function. According to Schunk (2009) motivation is when a student attempts to be the best or when he spends a lot of time to obtain his goals. Motivation has got great influence on the student's learning process, strategies, cognitive process and metacognitive awareness and helps him to reach his pre-determined objectives.

Based on Oner (2008), we have got two types of learning: deep and surface. The characteristics of deep learning consist of a tendency to understand the topic, having better presentation about that topic, expressing new perspectives based on past experience and being able to have justification. Moreover, he emphasizes that surface learning can be recognized by a willingness to fulfill the fixed forced topics, memorize their information, fail to distinguish between main and sub-topics, concentrate on independent points, be unable to make a link between the sub-topics, not be able to reflect on learning, and apply the correct metacognitive strategies to achieve the goals.

Tacit, aware, strategic and reflective are various kinds of learners (Harvey& Goudvis, 2007). “Tacit” which is student’s unawareness regarding metacognitive strategies. “Aware” which is when a student thinks about what he plans and does in learning deliberately. “Strategic” which is student’s organization about his thinking and “reflective” which is learners are not only strategic about their thinking but also reflect upon their learning whilst it happens, with considering the effective metacognitive strategies and revising the unsuitable one to the most appropriate one.

### **Metacognition and related neural structures**

According to recent neuroscience, a human being can use all brain resources selectively any time he wishes which is totally in contrast to the view that nearly 10% of his brain capacity is accessible to him. Based on Fleming& Dolan (2012), the prefrontal cortex (PFC) is the brain area which is specialized for metacognition. The PFC works with the brain posterior part although it is not anatomically connected to this region. Working memory, theory of mind and metacognition are related closely to the brain PFC and posterior parietal cortex (PPC). As Badre et al. (2011) find controlling over their learning including reasoning, monitoring, decision-making, moral judgment and even interaction between these has been accelerated by the PFC.

Dumontheil et al. (2008) revealed in their studies that the PFC develops even after maturation. Since myelin, which covers the brain white area facilitates signal transmission to the gray region in the way that all regions of the brain connect together with speedy neuron relation. We have development of the PFC for intelligent and risky activities. Significance regarding gray and white matter volumes is that metacognitive ability for successful and satisfactory learning is highly associated with brain gray part in the anterior PFC (Teffer and Semendeferi, 2012).

Some researchers (David, Newen & Vogeley, 2008) believe that some brain activities are associated with the learners' self-reflective assessment regarding control over their own learning and some other brain regions are related to investigation of the differences between observed learners' learning and expected learning.

We are required to consciously determine if we are in charge of a specific action or not. We should be able to metacognitively reflect on our real learning and identify neural patterns in it. As Decety and Lamm (2007) observe when the actual learning is different from expected learning, there are enhanced activities in the right temporoparietal junction (rTPJ), which includes mostly the supramarginal, the interior parietal rounded raised parts on the surface of brain, and sulcus posterior parts. Most studies (Meer et al., 2010) have been done to determine learners' behaviors, abilities and mental activities. The research results have strongly illustrated the cortical midline part, the middle and medial anterior prefrontal cortex (aPFC) are more active on self-attribution behaviors compared to other people-attribution behaviors (Meer et al., 2010). There is great activity in the aPFC when a learner reflects on his feeling while making decision. Further metacognitive analysis of Meer et al. (2010) shows that aPFC is more related to self-judgment than judgment about other individuals.

### **The metacognitive strategies recruited by self-regulated learners**

According to Zimmerman (1986) self-regulation is the degree that a learner is metacognitively, motivationally and behaviorally active in his learning process. It is believed that the major cause of less successful learners in learning is lack of enough degree of self-regulation.

Learners who apply more metacognitive strategies are more autonomous and self-motivated students. They are involved in more volunteer activities and recruit more planning, organizing, monitoring (Maxim, 2009; Zimmerman, 1986). Self-regulated learners have some characteristics. They are good thinkers, self-starters, autonomous learners. They know many metacognitive strategies, aware how, when and where to apply those strategies, have motivation to discuss about metacognitive strategies, believe in trying and not fearing of loss, have a wide range of information about various topics and have confidence (Maxim, 2009; Zimmerman, 1986). We can simply conclude that the students who know how to recruit motivational, cognitive, metacognitive



components are good self-regulated learners. As Fleming & Dolan (2012) state if an individual wants to make prospective judgments (predicting), he uses the ventromedial pre-frontal cortex (vmPFC) which is related to the future imagination but if he applies retrospective (reflecting) judgment which is associated to the past, the anterior and dorsolateral PFC are used. Furthermore, they discover that if there is any injury to the vmPFC, there will be a drop in the level of exact judgment about future performance while there will not be any impact on the level of self-efficacy. Moreover, Fleming et al. (2014) find that individuals with defects in the PFC exhibit deficits in auto-noetic knowledge. Thus, the healthy development and functioning of the PFC is essential for accurate self-knowledge, evaluation and reflection. Though plasticity which means ideas and experiences which make the learning better and easier, is related to learning in the past, reversal learning, cognitive control and flexible contextual planning these days are the key elements of metacognitive learning (Opris and Casanova, 2014).

### **Metacognitive strategies and self-regulated learning (SRL) acquisition**

Based on O'Mally and Chamot (1990) metacognitive strategies are "higher order executive skills that can entail planning for monitoring or evaluating the success of learning activity" (p. 44) and can make the learners more independent, self-directed and active. In other words, metacognitive strategies include thinking about mental activities and monitoring during learning and evaluating after learning. Self-regulated learning strategies encompass both cognitive and metacognitive strategies which assist learners to control, supervise and improve their own learnings and also help self-regulated learning (Zimmerman, 2008). Self-evaluation, organizing and transforming, goal-setting and planning, seeking information, environmental structuring (arranging the setting for easier learning), self-rewarding and self-punishment for success or failure in learning, seeking social assistance (getting support from classmates and instructors) and reviewing are all various types of self-regulated strategies applied by a self-regulated learner, according to Zimmerman (2008). Cognition, metacognition, motivation and content (different behaviors in different conditions) are four sorts engaged in self-regulation learning (Schraw, Crippent and Hartley, 2006).

When the learners use metacognitive strategies, the rostro-lateral PFC (rLPFC) is regulated. If learners switch their attentions to and from any parts of their own thoughts including “planning,” “rehearsal,” and “judging”, they can have more control on neural activity in their rLPFC. As a result, the accuracy of the judgment exactness concerning our performance will be specified by introspection. Some learners have been requested to have judgments before (prospective which is feelings of knowing) and after (retrospective which is judgment of learning) performance in some researches to measure metacognition. The individual belief that one's try will lead to actual learning is called self-efficacy (McCaig et al., 2011). Also, the attempts in encountering distractions and pressures both inside and outside academic context, is itself a self-regulated learning (SRL) strategy (Clark, 2014).

There is a close relationship between plasticity (growth) and the usage level of SRL strategies. If learners are going to be self-regulated learners, they must accept a “growth mind-set” based on Dweck (2006) not fixed one. Dweck claims that individuals who believe that their minds are growing are more skillful and successful ones than those who believe that they are fixed. According to Clark's (2014) findings, the appropriate academic environments and curricula with metacognitive strategies motivate a growth mind-set among the learners. Formative feedback (the deep involvement of students' active engagement in metacognitive strategies) which is supported by SRL helps learners to manage and control their own learning process and makes them more committed, responsible and effective learners (Black & Wiliam, 2009). Zimmerman & Maylan (2009) define SRL as an active, effective procedure where students set goals, monitor, regulate, and control their cognition. Self-regulated students are meta-cognitively, socially, motivationally, and behaviorally active. They highlight the benefits and advantages of learners as initiators, planners, and observers of their own learning programs.

### **Metacognition, self-efficacy (motivation) and self-regulation**

Based on Hasselhorn & Labuhn (2011), social matters, each person amount of activity, the maturity of neural system are key factors causing the differences in metacognitive competence of people. Many matured people apply more SRL strategies which is related to the PFC maturity during adulthood. As Zimmerman & Moylan (2009) claim SRL consists of planning, which leads

to self-efficacy, and performance, which is the result of self-observation and reflection. Reflection, the core of metacognition, checks if the set objectives for learning through applying metacognitive strategies are the same as the final academic achievement. Coutinho (2008) believes that metacognition and self-efficacy are the main factors for expanding SRL. He states that the relationship between metacognition and the achievement are mediated by self-efficacy. Consequently, we can say metacognition is related to motivation and self-regulated students are more metacognitively aware and motivated than other students. McCaig et al. (2011) define that teaching metacognitive strategies, motivational and cognitive factors which uses a greater part of the PFC is vital for successful learning. Motivation is a rudimentary element for self-regulated learners since it gives enough confidence to learners to believe that their minds are capable of successfully performing metacognitive processes before regulating learning. Zimmerman& Moylan (2009) found that with recognizing the level of self-efficacy, we can determine the amount of applying the learners' SRL strategies. Successful learning is dependent on the level of metacognitive awareness of the student and the amount of his self-belief.

Having feedback including questioning and replying which is leading to better performance is more in students with high level of self-efficacy than in learners with low level of self-efficacy. This means that instructors should use activities which contribute to feedback in the class to have self-regulation and self-efficacy. This definitely will lead to having more internal feedback in the learners which make them more self-regulated, confident and motivated. (Clark, 2014).

## Discussion

This article is the product of our struggle to learn how to foster metacognitive awareness for academic achievement. Activities related to metacognitive awareness that encourage self-regulating learning and applying metacognitive strategies should be included in class activities and instructions, especially at a university setting.

It has been highly notified that metacognitive awareness and self-efficacy are rudimentary factors through learning process. Accordingly, any positive or negative change that occurs in the level of learners' motivation and metacognitive awareness has got a direct influence on the learning outcome and achievement.

The anterior pre-frontal cortex is the main part that is involved in metacognitive awareness and learning (Chein & Schneider, 2012; Fleming & Dolan, 2012). Based on recent studies, the brain is reformed and cognition is controlled by the metacognitive system during the learning of new metacognitive strategies.

Furnishing learners with self-regulated learning that leads them toward being a self-directed and autonomous learner is one of the main objectives of modern education. (Bandura, 1987). Learners should entail the fostering of the metacognitive awareness to apply new and appropriate metacognitive strategies.

In our educational system, planning, controlling and evaluating learning process, self-assessment and self-regulating by learners are not present in the class activities. This reason is another point once more to call for a learning environment in which learners have more self-confidence and receive more positive feedback from their classmates and lecturers (Clark, 2014).

Since we cannot draw a boundary line between self-regulation, self-regulated learning and metacognition, distinguishing a line between cognition skills and their related strategies and metacognitive skills and their related strategies is a sophisticated task now and then. Metacognitive strategies are regarded as the most important factor for putting self-regulation into effect and there is no doubt an influence of metacognitive self-regulation on fruitful and effective learning.

Based on Zimmerman & Moylan (2009), for having ultimate learning, concentrating on cognitive dimension of self-regulation is not sufficient and focusing on a learner's affectional and motivational process and his self-belief is required as well. He believes that self-regulation is more than metacognitive skills. Therefore, he emphasizes on noticing the motivational, social and behavioral parts of self-efficacy while fostering metacognitive awareness and recruiting metacognitive strategies more than before. As a result, metacognitive strategy awareness guides the student to choose the most appropriate metacognitive strategies while the student's motivational belief is a determining factor in how to deploy the metacognitive strategy. In other words, there is a close relation between motivational beliefs and metacognitive strategy recruitment. Furthermore, as studies of Schunk (2009) demonstrate, a close link exists between learners' academic self-efficacy and their self-regulation strategy application. Those students who believe in their own learning and have better academic performance and cognitive engagement are

more likely to deploy more SRL strategies and attempt to be involved in more challenging academic activities in order to attain the pre-determined objectives. A self-regulated student is the same as a self-efficacious learner who insists on his belief though there is a lot of anxiety and nervousness and has got great motivation to reach his educational aims. It can be concluded that efficient self-regulation supports the learner's self-efficacy to self-regulate his learning.

*Educational Implications.* In order to develop learners' awareness, achieve better academic outcome and provide precious information to their trainers to have effective intervention, deploying metacognitive activities that request learners to reflect on what they know is necessary. Recognizing learners' metacognitive awareness levels and considering these levels in their instruction are two main factors that can help in enhancing metacognitive abilities of learners in the class.

The findings from this paper can deepen our understanding of supporting fostering metacognitive awareness and the application of its related strategies toward having more self-regulated learners and also considering emotional, motivational, behavioral aspects of self-regulation in an effective instructional program tailored for learners in an academic context.

Material developers and syllabus designers should also prepare the material to include some appropriate and sufficient metacognitive and self-regulated activities to enrich learners' learning. Instructors should be as models to prepare learning environment in the way to have more self-regulated learners to monitor themselves since if the learners are motivated to control their own learning direction then they can be responsible for it as well and the student's self-regulated learning can be augmented. Consequently, students can transfer what they have learned to other situations and have life-long learning.

## **Conclusions**

In the university setting, we can make best use of metacognitive awareness by prioritizing it with both explicit cognitive and metacognitive instructions, supporting metacognitive practices, promoting metacognitive talks via monitoring, evaluating performance and using metacognitive strategies effectively, making learning goals explicit and helping learners to plan and monitor toward achieving these goals, encouraging cooperative group work among the learners to evaluate

their own work and the group work, using self-assessment, focusing students' metacognitive knowledge regarding recruiting metacognitive strategies through free discussion in the class including when, how and why the strategies work and supporting the learners' autonomy.

Finally, there are numerous specific activities for the lecturers which are fruitful for fostering learners' metacognitive awareness. They can model metacognitive strategies by thinking aloud, managing peer interactions and having more related internalized processes, working with other lecturers to exchange recent and old experience in metacognition training, updating their own knowledge through on line specific related sources for trainers and workshops and using designed material to support learners in the process toward metacognition awareness.

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